Azimuthal Asymmetries in Fragmentation Processing Using $e^+ e^-$ Collisions

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In unpolarized electron-positron annihilation, there axe interesting and possibly non-zero azimuthal asymmetries [1], which measure novel chiral-odd fragmentation functions, such as the Collins function H_1 and two-pion interference fragmentation function. Recent results from the HERMES and SMC collaborations on azimuthal asymmetries using inclusive hadron production in DIS indicate that H_1 is different 'from zero and potentially rather large.

We will present the experimental method to extract the Collins and interference fragmentation functions using an $e^+ e^-$ collider experiment. $e^+ e^-$ collider experiments are in an excellent position to measure azimuthal hadron symmetries and to extract these fragmentation functions. These measurements require two-jet events originating from light quarks and the azimuthal correlations of hadrons around the jet axis on both event hemispheres. We believe that these fragmentation functions can be extracted from the data collected at off-resonance with the Belle experiment at KEK. KEK (and also SLAC or CESR) will have the advantage of larger asymmetries since H_1 scales with $2lnQ^2$, and the analysis will be also free from the additional complications at the Z pole where Delphi made an effort to extract two-pion interference fragmentation functions at LEP.

In addition to an interest to study these new fragmentation functions, they can be a strong tool to access proton quark transversity distributions. 'T'ransversity distributions are completely unknown currently and their knowledge is essential for a complete understanding of nucleon structure. Experimental programs to measure transversity distributions are underway at DESY (HERMES), CERN (COMPASS) and RHIC (PHENIX and STAR). The success of these programs critically depends on the availability of information on the novel fragmentation functions.

References

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